Theorem: It is the case that the sum of any five consecutive integers is divisible by 5

Proof: Take an arbitrary integer n. We will prove the theorem directly.

A sum of five consecutive integers can be represented as:
(n) + (n+1) + (n+2) + (n+3) + (n+4)
Combine terms = 5n+10 = 5(n+2)

n+2 will always be an integer so by the definition of divisibility $5 \mid 5n + 10 = (n) + (n + 1) + (n + 2) + (n + 3) + (n + 4)$ for an arbitrary n.
So the sum of any five consecutive integers is divisible by 5.
This completes the proof.